MODERN ALGEDONIC THEORIES.

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A great deal of attention is just now turned to various phases of the problem of pleasure-pain. This is no doubt largely due to the interesting results of experimental research upon sensation which has revealed unexpected physiological relations and awakens the hope of getting at a physical basis for the more remote but closely allied feelings. The most comprehensive recent work on pleasure-pain, which we may take as the text of this paper, is that of Marshall¹ which is perhaps already known to most of our readers.

We may add in passing that in typography and all that pertains to book-making the volume is quite satisfactory and, what is most surprising for a book from the Macmillan press, is tolerably bound. The author's work is thoroughly done and bears evidence of long study and reflection though not of personal investigation. It is a book that has been written rather than forged.

The point of view may be gathered from an introductory paragraph, "Pleasures and pains may be differential qualities of all mental states, of such nature that one of them must and either of them may, under proper conditions, belong to any element of consciousness."

It is interesting to compare the views of a still more recent writer upon the same subject. According to Külpe three views are possible respecting the nature of feelings. 1st. The feeling is a peculiarity of sensation. 2d. Feeling is a function of sensation. 3d. Feeling is an independent process of con-

¹MARSHALL, H. R. Pain, Pleasure, and Æsthetics, an essay concerning the psychology of pain and pleasure, with special reference to æsthetics. Macmillan & Co. 1894. \$3.00.

sciousness. Against the first view he decides because we find the same peculiarities, quality, intensity, and duration, which are ascribed to sensation. It is illogical then to speak of a process having these properties as a property of sensation along with the self-same properties. When the above properties disappear the sensation of which they are properties disappears with them but the feeling may vanish and the sensation persist. Feeling cannot therefore be a necessary attribute of sensation.

Feelings are in a sense functions of sensation in so far as an observed parallelism exists, but feelings are not directly dependent on the qualities of sensation. Nor is it directly obvious that the intensity of sensation determines its accompanying feelings.

The so-called elementary æsthetic feelings, in form and relations of sensation vary too much to stand in a fundamental relation to sensation. The author proposes the third view, that feelings constitute independent elements of consciousness.

But to return to Marshall; accepting four fundamental mental activities, sensation, emotion, intellect and will, he finds pleasure-pain much more closely connected with the former than the latter pair.

In favor of the view that pleasure and pain are sensations Mr. Nichols has urged that pains are as disparate as are many sensations. Marshall very properly replies that in those pains which seem most distinct there is always something beside the pain—a cutting, or pricking or the like which forms its criterion and serves to isolate it. We may add that pain and pleasure are *per se* essentially non-localizable. It is association with sensation which adds the localization. Pain from its character is much more likely to be thus associated, as we shall see, and this accounts for the fact noted by Marshall that the common usage is more likely to speak of pain as a sensation and pleasure as an emotion.

A second argument for the sensational nature of pain is derived from the fact that mechanical treatment may induce pain in a nerve trunk while no manipulation of them can pro-

duce pleasure. This is not entirely true for there is a more or less disguised pleasurable sensation due to striking the "funny bone" but, in general, Marshall's reply seems apt. The methods used in stimulating nerve trunks are, in the nature of the case, not normal. No evidence of special pain nerves, he claims, has been adduced. The fact that pain often is perceived after the sensation he explains as due to "the tendency ingrained in us to consider with promptness those elements in our experience which enter into the make-up of objects." We believe, however, that there are very simple physiological explanations of the delay. First, in many cases the delay is due to the fact that the causes of the painful sensation are secondary, such as congestion or vaso-motor changes and that these and not the primary irritation are the real sources of pain. A gross illustration is afforded by the pain felt when a pressure is removed from an inflamed spot, for example. Second, severe pains, in their passage to the brain, do not move along the direct sensory channels but by continual accumulation and overflow break away to the sensory centres via gray columns of the cord. A violent pain cannot be transmitted along the relatively narrow nervous channel of the fibre but by a series of explosive overflows finds its own way to the brain exciting sundry reflexes as it goes. This suggestion harmonizes the facts observed by Schiff, Myers and others which have been supposed to indicate the existence of special pain nerves. It is entirely possible for the fibre tract conveying sensation from a limb to be severed and yet the painful overflow to pursue its independent course to the brain when the anæsthetic region is injured. On the other hand, it is easy to see that hypnotic suggestion might effect a dislocation of the cell paths for pain without destroying sensation in the region considered. A great deal of spurious physiology has associated itself with these pleasure-pain speculations, among which may be noted Courmont's theory in his book "*Le Cervelet et ses Fonctions*," that the cerebellum is the seat of pleasure and pain. It is unnecessary here to follow the full and to us conclusive refutation which Marshall offers of the theory that pain and pleasure are sensations. The closing object-

ion to the theory, however, is worthy of special notice. Mr. Marshall does not believe that reproduced images of pleasures or pains similar to reproductions of sensation occur. A pleasant sensation may be revived or a painful one but not the pain or pleasure alone.

We remark here that, on the other hand, reproduced sensations are prone to produce present pains or pleasures to a very exalted degree. One sees a train passing and has all the acute emotional disturbance accompanying being thrown under the wheels.

The next step is to show that pleasure-pain cannot be identified with the emotions. "Emotions are the relatively fixed psychoses (instinct-feelings) coincident with correspondingly fixed coördinations of instinctive activities arising upon the presentation of determinate objective conditions."

If the definition helps little we are aided by a list including joy, dread, relief, love, fear, anger, surprise, etc.

Marshall admits that great physiological changes accompany emotions, quoting with approbation James' statement: "The bodily changes follow directly the perception of the existing fact, and our feeling of the same as they occur is the emotion," but seeks to avoid the idea that emotion is caused by the expression. Mr. Marshall cannot reconcile pleasure-pain with this definition of emotion. Emotions require no such perception. He suggests three possibilities:

A. Pleasure-pain may be fundamental—the basis of all psychic life out of which others have risen by development.

B. They may be elements *sui generis*.

C. They may be *quales*, special qualities common to all mental phenomena.

Horwicz supports the first in his *Psychologische Analysen* but does not succeed in tracing the line of evolution convincingly. It is apparent that "Gefühl" must be extended much as Spencer has extended feelings in order to adapt it to such a theory. Compare Ziegler, "Das Gefühl." The second theory is practically an abandonment of the attempt to analyse feelings and has no support from the physiological standpoint. Wundt

brings to bear the theory of apperception but the latter is itself much in need of explanation. Marshall adheres to the third view that pleasure-pain, like intensity, form *quales* of all presentation. According to this view it is not necessary to assume any special organs or nerves for pleasure-pain.

In Chapter IV is a comprehensive discussion of the physical basis of pleasure and pain. Five groups of theories are recognized; first, that pain is an overstepping of the limits of normal activity. Pleasure consists in a return to the normal state. The fatal objection to this theory in its simple form is the failure to account for pleasures of exercise.

Second, pain is due to tension, pain to equilibrium. This theory also fails to account for pleasure of exercise.

Third, pleasure and pain are contrast phenomena, one being the absence of the other. This theory fails to accord with facts of familiar observation.

Fourth, pain is due to limitation or restriction. Such theories the author thinks fail to account for pleasure. On the contrary, in no direction are physiological suggestions more direct than in emphasizing the connection between free irradiation of stimuli and pleasure. The fifth class includes such as connect pain with activities dangerous to the system and pleasures with healthful function. The great number of exceptions to this rule shows that however true this may be as a tendency it cannot constitute the basis of pleasure and pain.

As a working hypothesis Mr. Marshall formulates the following:

Pleasure is experienced whenever the physical activity coincident with the psychic state to which the pleasure is attached involves the use of surplus stored force. Pain is experienced whenever the physical action which determines the content is so related to the supply of nutriment to its organ, that the energy involved in its reaction to the stimulus is less in amount than the energy which the stimulus habitually calls forth. It is not a little strange that the author here and elsewhere seems to be oblivious of the nutrition theory of Meynert, which in some respects is a counterpart of his own.

We may profitably pause to compare the above statement with Külpe's analysis. This author recognizes the fact that there seems to be a constant relation between circulatory and other somatic changes and the feelings so that the former may be used as a measure of the latter. Dynamometer, sphygmograph, pneumatograph, and plethysmograph, all assist in estimating the feelings. Under pleasurable excitations the voluntary muscular action is enhanced and diminished under pain. The pulse becomes stronger without being more frequent in pleasure. The reverse is true during painful emotion, though after-effects complicate the matter. During pleasurable emotion the volume of respiration increases and the diameter of the superficial capillaries is increased.

Külpe concludes that an increased excitability of the sensory and motor regions of the cerebrum form constant accompaniments of pleasure. Study of the exaltation states of mania and the depression of melancholia leads to the belief that the sole physiological equivalent of pleasure is the dilation of the cortical capillaries, and that of pain is their occlusion.

Three theories of the origin of the feelings are recognized: 1, the *teleological*; 2, the theory of *peripheral origin*; 3, the *theory of central origin*. The first is simply an application of evolution to the problem in hand. It recognizes all normal physiological processes as the product of selection and inheritance. However, such a theory in its general form is far from affording a detailed explanation of the origin of feelings. The second theory applies only to sensory feelings and affords only analogies for the intellectual.

The author's theory above indicated that feelings are due to the state of excitability of the cortex and the latter to the blood supply is more inclusive than the two special theories of Meynert and Wundt. The latter derives feeling from the reaction of apperception upon sensation. Meynert seeks the cause in the nutritive states. In pleasure there is functional hyperæmia and an altered state of the cell protoplasm, while pain produces anæmia and degraded nutrition. In the latter case translocation of the stimuli is impeded and we have, as a result, sum-

mation of stimuli and explosive overflow of an injurious character.

Mr. Grant Allen claims that all strong pleasures result from the escape of stored up potential energy which has been hoarded for a considerable time, but at the same time "pleasure is the concomitant of a normal amount of function in sentient tissues." Marshall calls attention to what seems to him a contradiction here. But upon the hypothesis suggested in this paper there is no contradiction. All normal functioning is to a certain extent pleasurable. Pleasure is the result of the conscious participation in an unimpeded nervous function. The pleasure is enhanced in proportion as the amount of function increases and our attention to it increases (not necessarily varying proportionally by any means, however) until the function is checked or impeded. Such impediment may be offered by the limitation of nutritive power in the cell or by other stimuli impinging upon it from without. If when the normal activity of the cell is reached there are afforded sufficient avenues for the overflow of the stimulus to other like cells, an irradiation takes place enhancing the pleasure-giving power without producing abnormal functioning. This may be the physiological equivalent of what Mr. Allen describes as stored up potential energy.

Horwicz considers pleasure as a restoration of equilibrium. This however must be in a somewhat unusual sense. Physiologically pleasurable excitement is of the nature of restoration of equilibrium in so far as an excitement of one organ is transformed into a quickening of the functioning of all accessible organs but it is rather the method of such equilibration than the fact of it which explains the pleasurable nature of the process. Lotze recognizes the dependence of pleasure and pain on the employment of vital energy but added that a psychic perception of the organic advantage or disadvantage was the immediate cause. Bain seems to correlate pleasure-pain with stored energy and excess but not very intelligently.

Zöllner taught that pleasure is the psychical concomitant or aspect of the transformation of potential energy into kinetic, while the opposite process is painful. This is in effect a resist-

ance theory in its broadest expression. Marshall considers that the fact that pain accompanies destruction of tissue is fatal to the second clause of this theory. We should add that the evidence shows that nearly all if not all nervous functioning consists of rapid alternation of the two processes of metastasis and assimilation and that pleasurable excitements are due to such oscillations while pain may result from interference in the free functioning and transference of energy.

One of the most recent theories of pleasure-pain is that proposed by Mr. B. I. Gilman in a series of lectures published in a syllabus in the *American Journal of Psychology*, VI, 1. This theory of habit assumes that "the source of all pleasure is the performance by the nerves of activities which have once become familiar to them and that pain has its source in a violation of nervous habitude." Thus expressed it is a physiological theory closely associated with the resistance theory advocated by the writer. It is, however, extended as follows: "Any presentation correlated with a bodily process that tends to fix a habit (increases a trace [i. e. a vestige]) is pleasurable; while any presentation correlated with a bodily process that tends to loosen a habit (decreases a trace), is painful." Note in respect to this theory that such nervous processes as would increase a trace must necessarily be of super-medium nature, they must be unusually strong and therefore consume reserve force (as Marshall). On the other hand those which remove vestiges would be such as pass by explosive outbreak across the ordinary channels and at the same time infringe on the reserve cell content. The process devours not only the interest but the capital of the organism and with the latter goes the vestiges it may contain.

It will be seen, however, that this theory fails when applied closely to the simple sensuous pleasures and pains. As Gilman points out, his theory agrees in part with Aristotle's, who remarks that pleasure is the sign of the perfection of an act as the blooming cheek is of health, and with Herbart's, who says "By pleasure, therefore, I signify a passive state wherein the mind passes to a greater perfection."

But Gilman defines these ideals as laid down by passed ex-

perience of the organism ; moreover it is only those realizations which impress them more deeply on the habits of the organism that are pleasurable. His statement of theory is open to the criticism that it attempts to place the matter on a physiological basis without really approximating such an explanation. Gilman's theory is confessedly close to Fechner's stability theory. We need not follow this theory into its æsthetic applications in which field the author finds his most frequent confirmations. We cannot doubt that there is a large grain of truth in this theory and that its presentation will contribute much to the solution which shall finally be adopted.

The same may be said of Marshall's book, with its wealth of quotation and suggestion. In this connection we notice an interesting passage on habit which applies to the theory above noted.

"Pain does not necessarily tend to bring about obliteration of its content in future psychoses ; but may, in fact, on the whole, conduce to its vigorous reappearance in pleasurable form."

This fact the author explains upon the theory that repeated excitation increase the storage power [i. e.—the nutrition]. It is, however, capable of another explanation. When a violent stimulus has occurred in a cell group and is checked in its tendency to irradiate, summation occurs until the barriers are beaten down. The frequent repetition of this process sets up a tract of communication, irradiation becomes easy and a super-normal stimulus of this cell complex finally produces pleasure. Thus acquired tastes and thus the pleasures of intricate manipulation are explained simply and consistently. In a larger field too it is obvious that this theory explains the function of pain as preliminary to pleasure. Almost every new pleasure must be acquired by the painful process suggested. On the other hand too frequent and indifferent repetition causes the worn channel to pass off the stimulus with such facility that the threshold of pleasurable excitement is not reached. Attention aids in restoring the pleasure (or in relieving satiety) in so far as it inhibits and dams up, as it were, more or less of such wasteful overflow.

The large part of Marshall's book dealing with æsthetics and the art impulse we cannot include in this sketch but simply recognize its suggestiveness and interest to the psychologist and artist alike.

We add the following notes from Ladd's "Psychology, Descriptive and Explanatory," Chapter IX. *Feeling: Its Nature and Classes*. "With all this hopeful endeavor it will never be possible, however, to reduce to a strictly scientific form the life of sentiment and emotion. It is necessary, in the interests of science, to acknowledge this at the outset, and with the utmost candor." "The real and essential Nature of Feeling, as such, cannot be described . . ." "Description is in language, but language itself is the expression of conceptions and thoughts. And the conception of any feeling differs *toto cælo* from the feeling itself." Feeling is irreducible. The physiological and ideational theories are both rejected. The theory that feeling is pleasure-pain only; that apparant "qualities" are due to associations—this is simplicity "gone entirely mad."

Feeling is the subjective part of sense-experience. Those experiences therefore which are least objectified are richest in feelings. Feelings cannot be identified with the sensations.

Ladd claims to have abandoned "even the appearance of retaining the old and vicious theory of faculties," but read the following (p. 172). "All the neural processes underlying the different psychic facts are of *one* kind. But we have seen that, ultimately considered, in the light of introspective analysis, all the resulting psychic facts have *three* aspects; they are facts of intellection and connation not only, but also facts of feeling." "*Discriminating consciousness analyses in a triune way what psycho-physics regards as conditioned upon the occurrence of a physical change essentially the same.*"

"At any particular moment the kind and amount of feeling experienced has for its physiological condition the total complex relation in which all the subordinate neural processes, set up by the stimuli of that moment stand to one another and the set, or direction, of pre-existing related neural processes."

"We classify the feelings by reference to the intellectual

processes which accompany or occasion them. All attempts at a purely biological classification of the phenomena of feeling are, especially, to be rejected."

"The character and rate of the change which takes place in the sensational and ideational elements of consciousness determine certain characteristic 'feelings of relation.'" Here also belongs the discussion of the use of drugs etc., in affecting the emotions via effect on cerebral circulation etc. The primary forms of feeling are, however, unlike, *as feelings, qualitatively* and these differences accompany changes in time-rate of their sensational or ideational "occasions."

Chapter X. Feeling as Pleasure-Pain. The belief in the derivation of special sensations from primitive pleasure and pain is rejected. Pleasure and pain are opposite "tones" of feeling—both alike positive. Feeling may be dissociated from pleasure and pain; i. e. "neutral feelings" are probably possible. Goldscheider's "pain spots" are rejected as not proven. The pathological evidence—difference of rate of transmission of pain and touch, etc., are explained on the basis of diffusion of pain conductions.

Pain results from an undue increase of any cerebral process; but "the varying amounts of our pleasure-pains do not stand to the varying amounts of our sensations as the latter stand to the varying amounts of stimuli."

"All human life develops largely by relegating the immediate effects of our activity, as respects the quantities of pleasure or pain evoked, more and more to the background."

"In general, when the intensity of that unorganizable surplus of nervous excitement, that overflowing commotion of the nervous centres which is the physical basis of feeling, surpasses certain variable limits, pain is the result. It is, perhaps, because the ideal feelings are usually supported by less of this 'semi-chaotic surplus,' that they are less intense."

"All elaborate emotions and sentiments generally furnish some reasons why their tone should be one of pleasure, and other reasons why their tone should be one of pain." There are some *natural* or *normal* sensations which are painful.

We have hitherto made no explicit mention of what is now generally known as the Lange-James theory of emotion. In 1884 James and Lange independently published a theory of emotional consciousness so nearly identical that they may be practically treated as the same. Emotional feeling is for them the effect of those muscular and visceral organic changes which have been usually considered to be expressions of the emotion. The primary effect of the excitement is the organic change, the affection of consciousness is secondary. The various objections which have been offered to this theory have been admirably summarized by James in the September number of the *Psychological Review* for 1894, and the rejoinder makes some points much plainer than the original statement. One thing which has struck all critics is the fact that the external occasions of a given emotion may be so different with so constant a result. If the symptoms make the emotion the variability of symptoms should have a corresponding variability of sensation. This objection counts for little however. A chill is a very easily recognized and constant sensation, but it may be caused by the workings of a malarial phasmodium, a surface exposure, a mental state, a hemorrhage or one of a hundred other agencies. According to the analogy of the objection noted each form of cause should have its own corresponding species of chill. In our illustration as in emotion the vera causa is a nervous change in the central organ which may be produced in a great variety of agencies. In reading the objections and the rejoinder one is struck with the crudity of physiological concepts employed. Of course much must be conceded to the illustrative use of language, but the force of the whole discussion is chiefly spent on points which would disappear with a clearer apprehension of neural processes. Long before we are justified in looking for the constants of emotional determination we have passed from vaso-motor nerves to tracts or concatenated cell-series in the central system and from these to receptive dendritic plexi and their cellular sources.

The result of the recent discussion has been to bring all students nearer together and to cause all to admit the great importance of visceral changes in determining emotion.

Professor James has made the quite unnecessary admission that if a patient could be found who was quite anæsthetic within and without and yet suffered emotional disturbance his theory would be demolished. A very remarkable case has been reported by Sollier, in which the conditions were very nearly realized and Sollier concludes from this and experimental work on hypnotics that when totally anæsthetic the patient feels no normal emotion whatever at the suggestion of hallucinations and delusions which have the power of moving her strongly when the sensibility is restored. When the anæsthesia is solely peripheral, the emotion takes place with almost normal strength; when it is solely visceral, the emotion is abolished almost as much as when it is total, so that the emotion depends almost exclusively upon visceral sensations. This reporter seems too much like an *ex parte* advocate to be entirely convincing, and other cases have been reported which seem to negative the evidence. However, it must be remembered that one positive affirmative case is worth any number of negative instances for the essential conditions to be supplied lie deeper than the surface indications. All depends on where the circuit is cut. It is quite possible for all *sensation* to be prevented by the degeneration of tracts while concatenated cellular paths by which pain or pleasure stimuli pass remain intact.

In a series of articles published in the Psychological Review, Professor Dewey enters upon the question. Accepting the James-Lange, or as he calls it, the "discharge" theory, he attempts to show that the movements producing emotion all have a teleological value. This is neither new nor remarkable, for it would seem self-evident that from the standpoint of natural selection (a point of view too often neglected in psychological speculation even by those who occupy it in biology) no class of neuroses could acquire an important hold on consciousness without having recognized importance. In the second article Professor Dewey views the Lange-James theory from the teleological standpoint.

"Emotion in its entirety is a mode of behavior which is purposive, or has an intellectual content, and which also reflects

itself into feeling or affects, as the subjective valuation of that which is objectively expressed by the idea or purpose."

Dewey's article is valuable in making clear a difference of usage which has given rise to constant misapprehension. Some, like James, appear to mean by emotion only the "feel," let us say of being angry, while others mean the whole affect or state of anger of which the "feel" is, according to Dewey, a *quale*.

To us it is self-obvious that as psychologists we have only to deal with the conscious elements and however true it may be that the "feel" has no existence by itself as a full-fledged emotion-experience it is yet our obligation to treat it as distinct because we do instinctively abstract it from the impulses following, as from the physiological causes or concomitants though the latter may reflect themselves upon the feeling element never so potently or complexly.

A little careful analysis of James' theory shows that it amounts to this: our feeling of emotion is the psychical apprehension of states of our own body. Well, so are all psychical processes! What are the differentia which separate feelings from other such states? James says the reflected results of reflexes somatic or muscular. But we ask again what are the peculiarities of *these* rather than other stimuli that adapt them to produce emotions? Surely there is nothing self-evident in the suggestion that such reflexes are specially adapted to be causes of emotion. We reply that these and any other stimuli *primary* or *secondary* which tend to overflow the ordinary afferent channels and pass through concatenated cellular series acquire thereby a special character or summation power which is precisely the physiological *quale* sought. As thus stated we escape from many of the difficulties involved in an attempt to limit feeling to a product of motor or somatic responses to a stimulus. The shock which modifies the efferent apparatus is at the same time affecting the afferent.

We are then ready to follow Professor Dewey for whom the connotation of emotion is primarily ethical and only secondarily psychical though we may think he is greatly enlarging its rational extension in making it include a disposition and a way

of behaving—a certain practical attitude. By thus making emotion include sentiment and temperamental moduli he lays his own theories open to easy attack. The mode of behavior is for him the primary thing. The feeling element is super-induced. Thus the instinct to fight may have arisen and become perpetuated by natural selection until it is the inevitable response of the organism to a given presentation but no feeling of anger is necessarily implied. When the impulse is inhibited and is dammed up, as it were, by conscious coördination it becomes anger. Emotion is then the adjustment or tension of habit and ideal. So far as Professor Dewey's theory emphasises the inhibitory element in complex emotions he adds force to our own physiological theory by indicating how the higher emotional elements are translated into the proper physiological terms to produce feeling; namely, by inhibition, which soon gives rise to summation phenomena such as afford the peculiar *nisus* of feeling. We have here a dash of the resistance theory also.

Professor Dewey offers the following summary: "Certain movements, formerly useful in themselves, become reduced to tendencies to action, to attitudes. As such they serve, when instinctively aroused into action, as means for realizing ends. But so far as there is difficulty in adjusting the organic activity represented by the attitude with that which stands for the idea or end, there is *affect*, or emotional seizure. Let the coördination be effected in one act, instead of in a successive series of mutually exclusive stimuli and we have interest. Let such coördinations become thoroughly habitual and hereditary, and we have *Gefühlston*." We may remark that the theory as thus stated does not explain the appetencies and simple sensuous pleasures or gratifications; it is less happy in dealing with pleasure than with pain; the use of the term "attitude" is very unfortunate; and, finally, it fails to recognize many simple physiological facts. When we have agreed upon the nature of the simplest sense, pain and gratification, the foundation will have been laid for the more complex æsthetic phenomena. This foundation we believe consists in the recognition of a special

kind of neurosis for the feelings due to two classes of stimuli of a very similar but not identical kind. Given an excessive stimulus which for whatever reason freely irradiates and pleasure is felt, given another stimulus or the same excessive stimulus with other neural conditions which prevent irradiation and produce summation and overflow and pain is felt. With this as a basis we are prepared to analyse the emotional complexes as introspection and experiment may permit and refer each member to its own category. It will then appear that most of the conflicting theories have their truth elements and their reconciliation has been hindered by the attempt to seek for solidarity too far from the center.

The tendency is strong now-a-days to seek for a special differentiation of the nervous system corresponding to each psychosis. This leads to repeated efforts to identify a pain organ. One of the most extensive of recent attempts in this direction is that of Frey.¹

The author pleads for the recognition of a special "pain-sense" as an element of consciousness coordinate with the other senses and also for the existence of distinct end-organs and paths of conduction. The "Gefühlston" does not, then, constitute a necessary attribute of all sensations, but there may be on the one hand, pure (i. e. *unbetonte*) sensations and on the other hand—and much more important—pure feelings independent of ulterior sense-impressions. "Pain spots" can be localized and differentiated from other spots.

Again, some parts of the body are sensitive to pain, but not to touch, i. e. the least touch is painful—e. g. the cornea.

The organs of the pain-sense are spread over the whole body.

The painful sensation is referred much less to the affecting circumstance than to the affected organ.

Pain is peculiar in its intimate association with the reflexes.

May the feelings of desire be placed in some category as pain? The undemonstrable assumption that there is a special

¹FREY, MAX V. Die Gefühle und ihr Verhältniss zu den Empfindungen. *Antrittsvorlesung, Leipzig, 1894.*

sensory apparatus for desire (*Lust*) seems to the author unnecessary for he explains that it is the cessation of pain which produces desire. Desire is in general the more intense the more aversion (*Unlust*) is decreased; in this connection, too, it must be taken into account how rapidly the aversion diminishes (and this, at least partly, by contrast effect).

As at least suggestive along this line we notice that Cavazzani¹ records an interesting and valuable observation, illustrating the fact that different fibres exist in peripheral nerves for the conduction of different sensations, a fact often shown experimentally and symptomatically in certain diseases, but only rarely with such positiveness as in Cavazzani's case. The ulnar and median nerves were divided at the elbow by an injury. Nine months afterwards the ends were re-united. Eight weeks later normal sensation had returned down to the wrist. In the hand, temperature and muscular (pressure) sense were each markedly impaired, and in certain fingers, in very different degree, according as the fingers were supplied by the median or the ulnar nerve, leading the author to conclude that the ulnar nerve carried a less number of fibres for temperature sense, the median a larger number for pressure sense. There was also evidence of the disassociation of temperature sense, since in certain parts of the hand, particularly the end of the middle finger, only cold was felt, while sensation for heat and touch was totally lost.

In connection with Cavazzani's observations, appropriate mention may be made of a paper by Weir Mitchell,² describing a rare phenomenon in a clinical example of crossed thermo-anæsthesia,—left side of face and right side of body. Tact and pain sense were both normal, as were also taste, smell and hearing. The symptoms developed as a result of apoplectic seizure. Mitchell was unable to find any record of a similar case. Bremer³ writes in support of the theory of a central or cerebral pruritus, dependent upon morbid nutritional changes in the cor-

¹Schmidt's Jahrbücher, Leipzig, June 15, 1893. This and the two following abstracts are taken from the Annual of the Universal Medical Sciences, 1894.

²Medical Chronicle, March, 1893.

³Review of Insanity and Nervous Disease, Dec., 1892.

tex. He does not believe that the sensation of itching originates in the tactile corpuscles, although readily admitting that these bodies are the media of peripheral expression for the sensation. Certain analogies between itching and pain, touch and temperature sense, indicate a cerebral origin for all forms of peripheral sensorial impressions. He finds support for the theory in the pain of the hypochondriac and the hysterical, the itching of hypnotic suggestion, of neurasthenia and the itching aura in certain cases of epilepsy, etc.

But we have already seen that the evidence is far from convincing for the existence of special nerves for pain and must return to Goldscheider's paper in 1891¹ where, in discussing the summation phenomena of pain, he suggests that the secondary sensation is a summation phenomenon which probably takes place in the cellular elements scattered through the nerve tract. The cells store the energy which goes to them while that which passes directly along the fibres reaches the brain first. Subsequent accessions break down the cellular resistance and thus an explosive incremental stimulus reaches consciousness as pain. A single sensation if excessive may produce the like effect. Now accepting the accumulating evidence of a special cellular course for excessive stimuli we may inquire how simple pleasurable sensations are produced. Several hints are at our disposal. Many of these pleasures are accompanied by a peculiar nervous diffusion, as in tickling and the genial effect of warmth. This effect is known as irradiation and is also characteristic of higher states of pleasurable feeling. Both pain and pleasure depend on exalted stimuli, but the reaction of the system toward the stimuli largely determines their pleasurableness or painfulness. The same excitation may excite one or the other feeling at different times. Attention has thus a powerful but not regulatable influence. In the higher spheres of pleasure-pain this influence is more marked. This irradiation has a great tendency to involve vaso-motor channels, as we have seen above, while the summation processes of pain awaken various reflexes in their path

¹ Dubois Reymond's Archiv, 164.

which may increase the effect on the centres in a secondary way. Thus a somatic change, as sickness at the stomach, may be almost or quite coincident with the pain. To the above we may add the essential elements of Meynert's nutritive theory. It is obvious that the responsiveness of a cell is directly affected by its nutritive state and familiar experience shows that a state of malnutrition, whether of the body at large or the nervous system in particular, predisposes to pain and thwarts pleasure. The stimuli which ordinarily are indifferent or even pleasurable becomes sources of torture.

In extending the application of these suggestions to the emotions we may notice Professor Ladd's treatment in his most recent work of the somatic basis of emotions.

"Since all forms of feeling, when intensified so as themselves to feel, as it were, in a secondary way, the bodily resonance they occasion, become emotional, the development of each kind of emotion, as well as the development of the entire life of emotions, requires us to consider the somatic influences that are distinctive of them all."

"An emotion, physiologically described, may be considered as a sort of nerve-storm which gathers intensity, at first, in some comparatively limited region of the brain, but quickly spreads from storm-center to storm-center, as it were; which sweeps down the different paths of exit upon the lower centres and upon the different systems of muscles, upon the vascular and secretive and respiratory systems; and then from all these peripheral parts, return currents sweep backward further to disturb the centers that lie within the brain."¹

Compare also the following passage from another recent author:²

"Pain and pleasure do not originate where thought is developed, but are alterations of the functions of organic life rendered apparent through the agency of the medulla oblongata. This, then, is the centre of pain and pleasure, whether pro-

¹Ladd—*Psychology, Descriptive and Explanatory*, p. 544.

²SERGI, G. *Dolore e Piacere, Storia Naturale dei Sentimenti. Milan, 1894.*

voked by organic, physical, sensible stimulus in any part of the body, or by perceptions, ideas, thoughts transmitted through the brain. It is from here that the impulses proceed that modify and disturb the organic life, beginning with the heart and the respiration."

Finally, then, we venture to quote nearly in full from the Supplement to Woods Reference Handbook of the Medical Sciences an article embodying our own ideas respecting emotions, in their physiological relations :

The scholastic and convenient tradition which divides psychical manifestations into cognitions, volitions, and feeling, permits us to single out a class of so-called mental manifestations, which are conceived to be determined by a form of the receptivities of mind known as the susceptibilities. The most careful writers have discovered in this group of "faculties" a perennial source of dispute and ambiguity.

Older psychologists conceived of feeling as obscure or implicate thought, or as impotent or unexpressed impulse or will.

Hoeffding defines feeling as "that in our inward states which cannot by any possibility become an element of a percept or an image;" as "an inner illumination which falls on the stream of sensations and ideas." Both these expressions indicate the difficulty involved in isolating feelings, the one being negative, the other an illustration. Sibbern notices that feelings and will have this in common, that in both "the ideas involved have a personal hold and effect, so that we yield ourselves up to them and are incited to act and strive for their realization." Recognizing the futility of the distinctions usually made, James has boldly used feeling as synonymous with the word psychosis or subjective state, and made no attempt to distinguish it from thought. The emotions (German *Effecte*) are described as a bubbling up of feeling which may greatly influence the course of cognitions and volitions, or temporarily inhibit or stimulate them. If emotions be strictly limited to feelings with psychical (cognitive) occasion or accompaniment, much ambiguity may be avoided, but it would still be necessary to insist on the es-

sential similarity of these feelings to others with simple sensational basis. The following classification may prove convenient:

I. <i>Feelings.</i>	Sensations.	Sense gratification and pain.	General or total feelings.
II. <i>Occasions.</i>	Normal (moderate) sensory stimuli.	Super-normal stimuli, with tendency to irradiate.	Diffuse (somatic, especially "total") stimuli.

Emotions.	Impulses.	Sentiment.	Disposition.
Somatic changes occasioned or accompanied by cortical activity.	Reflexes excited by somatic and cortical activity.	Persistent cortical changes.	Reactions of cortical residua on new data of consciousness.

This series of subjective states is not to be regarded as arbitrary, but capable of the most far-reaching inter-penetrations. Of course it may be claimed that there is a great gap between sensation, or even bodily pain and pleasure, and the emotions which depend chiefly upon data of a higher intellectual character. Between these two groups is another, which seems, in part at least, to bridge over the interval, the total or general feelings.

Sensations, as the most direct responses of the consciousness to external irritations in which the bodily participation is more direct than in the subsequent processes (perception, etc.), afford the simplest data of consciousness. Even in this case, however, the nature of the response varies with the organ in respect to the amount of subjective participation. Thus, sensations are excentrically projected or externalized; the former in the case of tactile, gustatory, thermic, and algesic senses; the latter in the case of special senses—visual, auditory, and olfactory.

That this is not a primitive difference, but is developed through associations of several senses, is proven by such facts as that when a blind person is suddenly given sight, the external world seems to touch the eye, *i.e.*, is excentrically projected rather than externalized. That externalization is possible to the tactile sense or "muscular sense" is shown by hyperexcen-

tric reference of sensations of double contact, as when the blind man seems to feel an object at the end of his cane, or the surgeon's sensation is transferred to the end of his probe. We may dismiss, as beyond our limits, the three sciences—optics, acoustics, haptics (the skin and muscular sensations)—and there still remains a set of sensations which may be conveniently grouped as general sensations, which bring us into closest relations with the lower special senses, olfaction and taste, and the diffuse sensations on one hand, and subemotional processes, like elation, ennui, and depression, where total sensations and rudimentary feelings fuse.

It must not be forgotten that pain and sense gratification are strong elements in the emotions and require a careful examination. Hoeffding says "feeling stands out plainly, as an element different from the actual sensation, in certain experiences, which prove that the pain caused by an excitation takes longer to be produced than the actual sensation, and that sensation may arise without the corresponding feeling, and *vice versa*." Richet says "pain without memory and without radiation would be no pain at all." Often an interval of one or two seconds may elapse after the sensation is perceived before pain appears. These cases, so often quoted as proving the distinct nature of pain, are in one respect fallacious. When a nerve-fibre is penetrated by a pin the pain is nearly, if not quite, as promptly felt as the touch. When the finger is struck by a hammer the pain is frequently long delayed. But the acme of pain in that case is due to a reactionary process in the tissues, notably the vascular contractions, etc. There may be several oscillations of pain and a set of summations of a curious character. It is even possible, by bringing to bear counter-irritants, to preclude these after-effects and mitigate the pain, as by rubbing or pinching the part.

In the case of a burn the conductivity of the tissues and vascular responses are even more evident, and such attempts to differentiate pain from sensation as a modality of feeling are futile. The fact that there may be analgesia without anæsthesia, and *vice versa*, is tentatively explained by the recent suggestion,

that thermic and painful sensations find their way to the cortex through the gray matter of the cord instead of the fibrous columns, and affords us added data for the generalization for which we are now ready, viz : Feeling is always composed of two sets of factors ; first, a sensational, and second a cognitive or intuitional element. The sensations which directly participate in feeling are non-localized (general or total sensations), or are so acute as to irradiate, and thus ally themselves with total sensations. The cognitions or intuitions are primarily such as identify the subjective state with the empirical ego. The association of reflexes and instinctive responses converts the feeling into an impulse which is usually embodied in the so-called emotion.

James identifies instincts and emotions as two forms of impulse, in this usage betraying German influence. He says that the class of emotional is rather larger than that of instinctive impulses. Its stimuli are more numerous, and its expressions are more internal and delicate, and often less practical. The physiological plan and essence of two classes of impulse is the same. This identification of the expression of the emotion with the psychical element (feeling) seems illogical, inexpedient. Instincts may have an emotional origin, or may be of the nature of impulse deprived of its psychical element ; but pure instinct is not emotional, though emotions may be awakened by a resistance to the gratification of the instinct. An impulse stands on a present or historical basis.

With this difference in distribution, the theory of emotions proposed by Professors Lange and James goes far to place the emotions on a plane of scientific research. As expressed by the last named, his theory is about as follows : Bodily changes follow directly the perception of the exciting fact, and our feeling of the same changes as they occur is the emotion. Objects excite bodily changes by a pre-organized mechanism, and these changes are so indefinitely numerous and so subtle that the entire organism may be called a sounding-board, which every change of consciousness, however slight, may make reverberate.

Everyone of the bodily changes is felt acutely or obscurely the moment it occurs.

James says: "If we fancy some strong emotion, and then try to abstract from our consciousness of it the feelings of bodily symptoms, we find we have nothing left," . . . "a cold and neural state of intellectual perception is all that remains." "The more closely I scrutinize my states, the more persuaded I become that whatever moods, affections, and passions I have are in very truth constituted by, and made up of, those bodily changes which we ordinarily call their expression or consequence." These quotations serve at least to emphasize the importance of the corporeal element, however much they ignore the cognitive element. The natural and logical criticism is that the *effect on consciousness*, which is all we get out of feeling, is wellnigh overlooked.

Emotion consists (1) of general sensations of total, organic, or irradiating varieties which have in common a lack of localization and, as a result of associational laws, are amalgamated more or less closely with the empirical ego; (2) of more or less explicate or implicate cognitions (perceptions, intuitions) of the relation between the cause of the sensation and our well-being; (3) the emotion is more or less closely attached to various impulsive expressions which tend in various ways to intensify the two preceding. More in detail: The sensations are produced in most cases by vaso-motor changes which, in turn, produce "total sensations," usually entirely unlocalized and not necessarily distinguished apart from the feeling. Such sensations may be recognized, and to some extent analyzed, by practice. They precede the emotion proper and compose its sensational element. When one lies half asleep in the morning and a loud report startles him, the sudden surging of the blood to the periphery produces a familiar but indescribable sensation, which may include tingling at the finger-tips, a curious twinge in the axials, a suffocating sensation in the chest, as more specific accompaniments. Then a flash of fancy depicts the burglar in the kitchen and a scene of bloodshed, danger to self, and the like; now perhaps a strange "gone" feeling in the abdomen, and a helpless atonic condition

of muscles follow; then impulse dominates, and the tendency to spring to the defensive arises; all this before judgment announced that the cook has slammed the range door. Granting that the illustration has served to indicate the meaning of the statement above, it need require but brief experiment and self-observation to show that vaso-motor and organic changes always accompany and afford a sensational basis for feelings. A just analysis will not neglect the subjective process in construing the physical. Stripped of the sensations above referred to, and the instincts and impulses associated with them, the residuum is still not to be passed over. "A feelingless cognition that certain circumstances are deplorable," or otherwise, may be, and generally is, but the first step in a series of judgments or representations out of which spring the involuntary acts which are the really important results of emotion. The sensational element is that which represents the general, though subtle, bodily effect of the stimulus (be it physical or psychical), while it serves to awaken within us the empirical ego (the sum of our purely subjective bodily reactions on consciousness), which gives point or poignancy to the following psychical processes and links self with phenomena, awakening the participation of the soul in the states of the body, or of other beings, which otherwise might concern us only as do phenomena in Mars. It is then no mere figure which localizes the emotions in the heart or bowels, but a statement of sober physiological truth. A heartless man is one whose intellectual appreciation of the results of an act does not awaken sympathetic thrills in his physical being adequate to quicken in him a participatory or sympathetic state. Such a condition may be acquired by habit or produced by heredity. Practically, we are first interested to study the physical substrata conditioning the emotional temperament and its expressions.

The sensrtional elements in emotion are, first pains and sense gratifications; second, obscure organic and total sensations which are not usually perceived as such, but are interpreted as part of the feeling; third, reproduced pains or gratifications always followed or accompanied by total sensations;

fourth, representations which awaken by association either reproduced pains and gratifications which, in turn, give rise to total sensations, or the latter without the former ; fifth, instincts, which obey laws of association whose rational explanation lies in the development or phylogenetic history.

Pain and sense gratification are more difficult to construe, because more direct and simple than the others named. So long as pain, etc., were regarded as simply exaggerated forms of ordinary sensation the problem was insoluble. That this is not the case is suggested by the fact that they pursue other courses in the cord, and are associated more closely with thermic sensations. If a small area of the skin is isolated it is found that tickling with a feather is interpreted as warmth, and a thrust with a needle cannot be distinguished from heat. In other words, if the local signs by which position is recognized are excluded, the differences break down. It may be noted that general changes in temperature states are closely connected with the general feelings, as witness a shudder or the cold chills of fear, and the glow of pleasure. Briefly stated, the peculiarity of pain and intense gratification of sense which adapt them to become sources of feeling, is their diffusive (irradiative) character. If the current suggestion that algæsic stimuli pass by conduction through the gray matter of the cord be substantiated, a much closer connection with the visceral centres than hitherto suggested may be postulated, and the thrill of pain can be readily interpreted as the sympathetic contraction wave passing throughout the vascular system. The evidence for the existence of adequate vaso-motor causes of the sensational element in emotion is largely subjective, but those familiar with nervous diseases will not lack for evidence that variations in circulation are powerful factors in emotional disturbance. Shame is an emotion quite independent at times from any judgment of adequate occasion for chagrin. It is very closely connected with peripheral vascular changes. In anæmic or neurotic persons the flush may come without any external exciting cause, and yet frequently produces all the subjective effects of shame. Not very infrequently this symptom becomes intolerable and almost

alone drives one from society. Still more frequently psychical reflexes become associated with it and enhance its power. Fear, which originates in a shock or contraction wave of the vascular system, bringing a whole series of visceral and secretory changes in its wake, illustrates the possibility of separating the sensational from the cognitive element. Dreams often afford instances of all the physical manifestations of fear, with no adequate cognitive process. The writer has dreamed of being the actor in a play in which fear of impending danger entered, and, in his capacity as actor, felt fear (sensational); while in his capacity of critic he, at the same time, observed the entire inadequacy of the supposed occasions of fear.

Lange says: "No one has ever thought of separating the emotion produced by an unusually loud sound from the true inward affections. No one hesitates to call it a true inward affection. No one hesitates to call it a sort of fright, and it shows the ordinary signs of fright. And yet it is by no means combined with the idea of danger, or in any way occasioned by associations, memories, or other mental processes. The phenomena of fright follow the noise immediately, without a trace of spiritual fear. Many men can never grow used to standing near a cannon when it is fired off, although they perfectly know that there is danger neither for themselves nor for others—the bare sound is too much for them." One who has walked over a railroad trestle by night and narrowly escaped a fatal plunge by observing just in time the absence of a tie, will be able to recall the peculiar series of organic sensations involved. The thrill of vaso-motor disturbance pervading the body—the twitch of the radial artery—the pain in the sternal region—the suffocating sensation in the breast and lump in the throat—and finally, the "gone" sensation in the abdomen somewhat resembling a sensation of cold, and due in all probability to vaso-constrictor reactions in the visceral vessels—these, and many more, illustrate the bodily effects which may wholly precede the apprehension of danger, and may be enhanced by a variety of imagination pictures, and may express themselves in impulsive gasps and gestures. It is not necessary to call attention to the fact that

mental images may be almost equally effective with the actual external irritations in producing the sensational responses of emotions. Before passing from the direct sensational elements, however, it may be noticed that those senses which externalize their data (vision, hearing, etc.) have special powers over the emotions which may in part be explained by a sort of central (bulbar?) irradiation. Simple colors and musical sounds produce a vague and feeble pleasure unworthy to be called emotional, but similar to the normal subjectivity of nervous action; but a symphony or aurora plays on the sensitive organism like a harp. The writer, without musical tastes or education, confesses to the tumult of indescribable sensations produced by Wagner or Beethoven. Flushes of cold and heat; tinglings and palpitations local and general; gusts and torrents in the blood; creeping, swelling, scintillation of the skin; giddiness and elation—these and indescribable “all-over” sensations are easily separable from intellectual appreciation, which may even be absent; and one may be a wandering spectator observing the irrational gyrations of his own sense to tintinnabulating stimuli upon which judgment turns the cold shoulder. Another class afforded by the tickling and shuddering, or irradiation sensations proper, further illustrates the necessity of diffusion in emotional sensation. The slight sensations of tickling, aided by subjective modifications, extend in most varied and irresistible sensations over the whole body. Its emotional character is almost wholly apart from the intellectual element. The shudder and chill which spring from a gritting sound or the velvety touch of a peach, imply in addition considerable instinctive elements.

The effect of instinct is powerful in the emotions generally. The faintness at sight of blood may be entirely apart from apprehension. The universal creepiness inspired by the approach of a harmless snake or the proximity to a precipice, are illustrations of a form of sensation obviously highly developed in animals (witness the rising hair of the new-born kitten at the odor of a dog). The sight of many small animals, pets, or children, produces a marked thrill in most children, often accompanied by curious sensations at the root of the teeth (analogous to the

sensation sometimes felt with surcharged bladder), and accompanied by strong impulse to squeeze or hug the animal, to contract the muscles of the jaws, arms, etc.

These are often very powerful sensations, and productive of almost violent impulses. They are analagous to certain sexual instincts (perverted in gynophagia, etc.), but are quite distinct from them.

The impulses of emotion have received careful study, and only too often have been identified as part of the feeling. If it were desired to analyze emotion as of three-fold character, thus: sensation, cognition, impulse, there could be no serious objection, except that impulse does not always require consciousness of its occasion as emotion must. Strong evidence as to the nature of emotion is afforded by the fact that imitation of the expressions of emotion reflexly awaken the emotion, while vigorous repression of these impulses quickly obliterate it. Distraction of the attention may check the tempest rising in a child's bosom which, once overflowing, could only find relief in exhaustion.

Many persons who are not suspected of neurotic disease, have a transitory mania which exhibits itself in paroxysms of fury as blind and unreasonable as those of a maniac, and which may be occasioned by trivial circumstances. The fact that impulsive responses to emotional excitation have this reflex power is a significant one in the treatment of nervous disease. Bucke's description of nervous dyspepsia may find a place here. "All physicians who have been much engaged in general practice have seen cases of dyspepsia in which constant low spirits and occasional attacks of terror rendered the patient's condition pitiable in the extreme. I have observed these cases often and have watched them closely, and I have never seen greater suffering of any kind than I have witnessed during these attacks.

. . . Thus a man is suffering from what we call nervous dyspepsia. Some day, we will suppose in the middle of the afternoon, without any warning or visible cause, one of these attacks of terror comes on. The first thing the man feels is great, but vague discomfort. Then he notices that his heart is beat-

ing much too violently. At the same time shocks or flashes, as of electrical discharges, so violent as to be almost painful, pass one after another through his body and limbs. Then in a few minutes he falls into a condition of the most intense fear. He is not afraid of anything; he is simply afraid. His mind is perfectly clear. He looks for a cause of his wretched condition, but sees none. Presently his terror is such that he trembles violently and utters low moans, and at this stage there are no tears in his eyes, though his suffering is intense. When the climax of the attack is reached and passed, there is copious flow of tears, or else a mental condition in which the person weeps upon the least provocation. At this stage a large quantity of pale urine is passed. Then the heart's action again becomes normal and the attack passes off." It is not the purpose of this article to suggest remedial or obviating procedure, but it is obvious that the vaso-motor conditions in hypochondria and nervous acme of all kinds acquire new significance in this connection.

Another group of phenomena connected with emotional excitement has recently been adverted to.

In a paper before the International Congress of Experimental Physiology, session of 1892, Professor Hugo Münsterberg details the results of experiments, showing that the emotional states react differently on the extensor and flexor systems of skeletal muscles. After having for some time practised moving an index on a scale ten or twenty centimetres centripetally and centrifugally, until the distance could be quite accurately estimated with closed eyes, he tried the same experiment while experiencing pleasurable and painful emotions. The results are interesting. Purely physical variations, such as would be expected *a priori*, are seen in the under-estimation of the distance in dull or serious moods, and over-estimation when excited or amused. But psychical variations appear when they would hardly have been expected. Thus in unpleasurable emotions the extensor motions are too small, while flexor motions are too large, and during pleasurable emotions the flexor motions are too small and the extensor motions too large. The

author does not hesitate to found on this observation the theory, that it is not simply true that painful emotions produce flexor motions and pleasurable emotions extensor motions, but that the psycho-physical effect of the reflexly produced extension and flexion is precisely what we term pleasure or painful emotion. A farther generalization is that extension must always, from the biological stand-point, occur with serviceable, and flexion with harmful, irritations.

Even the infusoria exhibit the same tendency. This lies at one extreme, while at the other the pleasurable emotion of assent is but an associated reproduction of earlier extensor motions, and *vice versa*. Pain and pleasurable sensations acquire emotional value only through the aid of associated muscle sensations, *i.e.*, such as form the foundation of our empirical ego.

These suggestions are expressed in a somewhat different form in Tuke's well-known text-book. "By acting chiefly on the flexor muscles, fear causes the general bending or curving of the frame; while courage contracts the extensors, and produces expansion and height."

"The opposite muscular states of contraction or tension and relaxation alike find illustration in the emotion of terror, for with the signs of the former already mentioned, and the stare of the eye, are combined the relaxation of the masseters, the sphincters, and the processes of organic life." "Calmness—a placid condition of the feelings generally—is marked by a gentle contraction of the muscles, indicative of repose, but at the same time of latent power—by the countenance free from furrows, but not relaxed into weakness. Anger or rage contracts the masseters, inflates the nostrils, furrows the forehead, and exposes and rolls the eyeballs, clenches the fist, and induces a violent action and more or less rigidity of the muscles generally."

"As all movements have for their great end the preservation as well as the enjoyment of the individual, and as contraction and relaxation take place primarily to attain this end, a general expansiveness of expression and gesture is allied with all the emotions which are excited by impressions (or generated

by ideas) of a beneficent character ; while a general exclusiveness or contraction of features is allied with emotions excited by maleficent expressions ; the object of one class of movements being to court and receive, and of the other to avoid and reject." "Pleasurable and painful sensations from without determine, then, the form which the muscles called into action assume ; the purpose being to protect the organs. Similar muscular changes arise from the emotions, according as they are pleasurable or painful, in consequence of the harmony between mental and bodily acts."

The existence of impulses of the most recondite and adaptive sorts need not be denied, nor can it be doubted that these reflexly contribute to the emotional element. It must be urged, however, that emotion, strictly speaking, is subjective and must not be identified with its bodily occasions or results. The practical problem is to acquire control over the conditions.

The transition from emotion to sentiment is imperceptible. Joy and sorrow are sentiments growing out of pleasure and displeasure, and these have their counterparts in sense gratification. Conjugal love is the sentiment of which passion is the emotion, for which erotic excitement may afford one sensational basis.

The rhythmical flux of the feelings is explained by physiological oscillations. In the morning, when the current of life is full, emotions are not easily awakened. A morning audience is not a responsive or emotional one. The processes of nutrition exert a powerful effect. Physiological acme, like puberty, and the climacteric, predispose to emotions. The early development of the sensational element of emotion and its preponderance in the lower animals has been thought to imply that feelings are prior to cognitions. A more just analysis recognizes the psychical element of emotion as essentially intellectual, and abandons the attempt to secure a serial relation of the "faculties."